

9. On the Land Shells of the Island of Socotra collected by Prof. Bayley Balfour. By Lieut.-Colonel H. H. GODWIN-AUSTEN, F.R.S., F.Z.S., &c. Part I. Cyclostomaceæ.

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(Plates XXVII., XXVIII.)

For the recent exploration of the Island of Socotra we are very greatly indebted to Mr. Sclater, who from the first so strongly advocated the examination of its flora and fauna. This work has been most ably carried out by Prof. Bayley Balfour, who volunteered his services, and who, after a necessarily short stay there of only six weeks in the cold season of 1880, brought away with him a fine store of specimens. The present paper is based on a study of the land- and freshwater Mollusca thus obtained.

It is proposed to bring out this list in two parts, instead of waiting until the whole collection has been examined and compared. The first contribution, now submitted, comprises the Cyclostomaceæ. As a whole, they are, as might have been expected, African and Arabian in character, the connexion being certainly, as regards the operculated forms, more Arabian than African. The collection contains a number of very distinct, fine and interesting forms, of which some were already known, but many are new and considerably extend the list of Socotran species. The large area of limestone formation on the island is especially favourable to the existence of these creatures, while island-conditions have, as usual, modified and increased the species of some genera. I hope to be able to show to what extent the species are allied to the adjacent continental forms—always so interesting a point as regards island faunas. The Helicidæ number about twenty species, the operculated species ten, while there are some eight freshwater, or a total of about forty. It is remarkable to note that there is not a single true *Helix* represented in the collection: one specimen I did at first think was a *Helix*; but it is in a very imperfect state, and on further examination appears to belong to the Buliminæ.

Species of Buliminæ are the most numerous among the Helicidæ, the greater numbers being allied to Mr. G. Nevill's subgenus *Achatinelloides*, which is closely allied to a group which extends through Arabia and Persia to N.W. India.

Of the genus *Otopoma*, represented in Socotra by six species, there is found in the neighbouring island of Abd-el-Goury *O. modestum*, Petit, which is not in the collection and appears to be peculiar to that island, as also *Cyclostoma gratum*, a genus not represented in the collection.

It is interesting to note how restricted *Otopoma* is to Arabia and the islands off the east coast of Africa. The only exceptions are:—*O. albicans*, Sow., in the British Museum, given as from the island of

Hainan, China, according to Benson¹, but which possesses all the characteristics of the Socotran shells, and must be, I consider, wrongly labelled; there is also one recorded from the continental shore of Mogadoxa, viz. *O. guillani*; and we have an outlier in one species on the other side of the Arabian Sea in peninsular India, *O. hinduorum*, recorded from Kattiawar and named by Mr. W. T. Blanford.

Again, in *Cyclotopsis*, a genus belonging to the Cyclostomidæ, but with a multispiral operculum, we find the connexion of Socotra not with Africa but with peninsular India on the one side, where it is represented by *C. semistriatus*, and in the far south-east, in the Seychelles, by another species: this has been already pointed out by Mr. W. T. Blanford in a paper (Ann. & Mag. Nat. Hist. 1864) "On the Classification of the Cyclostomaceæ of Eastern Asia," and more recently (in the same publication, 1876) "On the African Element in the Fauna of India."

Lithidion, again, follows a very similar distribution, with the exception of India, all the species being East-African island forms, though not extending southward beyond Madagascar. On the north it is found in Arabia, but has not, I believe, been recorded from the African coast, which, however, has been little explored.

Tropidophora is a purely Madagascar genus, where it has reached its maximum of development and beauty in some magnificent shells; and it occurs in most of the East-African islands, viz. Mauritius and Rodriguez,—in the first represented by the very rare *T. barclayana*, and in the second by *T. articulata*. *Tropidophora* we now find spreading as far north as Socotra; but this genus has never been found in India.

Judging from the land-molluscan fauna of Socotra, there is strong evidence that the island was once directly connected with Madagascar to the south. We know the great antiquity of that island; and it is not unreasonable to suppose that in Socotra, the Seychelles, Madagascar and Rodriguez we have the remnants of a very ancient more advanced coast-line on this western side of the Indian Ocean, which line of elevation was probably continuous through Arabia towards the north. With an equally advanced coast on the Indian side, the Arabian Sea would, under these conditions, have formed either a great delta, or narrow arm of the sea into which the line of the Indus and Euphrates drained. Such conditions would have admitted of the extension of species from one side to the other, which the later and more extensive depression of the area, as shown in Scinde, afterwards more completely shut off.

OTOPOMA NATICOIDES. (Plate XXVII. figs. 1, 1 a.)

Cyclostoma naticoides, Récluz, Rev. Zool. 1843, p. 3.

Shell globosely turbinate, very solid; sculpture well marked transverse irregular lines of growth crossed by distant indistinct spiral sulcation. Colour white, fine orange within the aperture. Spire rather high, the extreme apex generally decollate. Whorls

¹ Sowerby in his original description gives no locality.

5, well rounded. Aperture obliquely and broadly ovate, angular above, suboblique. Peristome thick and solid, particularly on the columellar margin, where it spreads out and completely conceals the umbilicus; this is a greater development and exaggeration of the angulate notch which is to be seen in the next two species from this island. Operculum situated well within the aperture, flatly concave in front, shelly, smooth, of about $3\frac{1}{2}$ whorls, nucleus sub-central.

Size of largest specimen—major diam. 59·5, minor diam. 5·1, alt. axis 31·5 millims. Largest size given by Pfeiffer—major diam. 41·0, minor diam. 34·0, aperture 19×16 millims.

Example figured—

major diam.	2·15,	minor diam.	1·7,	alt. axis	1·35 inch.
"	" 54,	"	" 42·5,	"	34·0 millims.
Small var.—					
major diam.	38,	"	" 30·7,	"	18·5 "
"	" 1·32,	"	" 1·0,	"	0·53 inch.

Animal not yet examined.

[“Very common on the limestone plains from more than one locality.” (I. B. B.)]

O. guillani, Petit, is a small form, diameter 26 millims., very similar in the expansion of the columella-notch over the umbilicus, from Mogadoxa on the N.E. coast of Africa, 250 leagues distant from Socotra.

OTOPOMA BALFOURI, n. sp. (Plate XXVII. figs. 2, 2 a.)

Shell globosely turbinate, solid, very openly umbilicated, ribbed regularly and spirally throughout; but the ribbing does not extend within the umbilicus; colour white; spire pyramidal, decollate usually for $1\frac{1}{2}$ whorl; suture well impressed; whorls 4, well rounded; aperture subvertical, ovoid, angular above; peristome continuous, solid, and reflected slightly on the outer margin, less solid on the columellar side, which presents a slight dentation with angularity just below the upper inner margin, well rounded below.

Size:—

Major diam.	55·0,	minor diam.	40·0,	alt. axis.	22·0 millims.
"	" 2·16,	"	" 1·58,	"	0·87 inches.
Dwarf var.					
major diam.	32·8,	"	" 26·5,	"	14 millims.

[“Common on the land towards the east end of the island: this portion is elevated over 700 feet and is of limestone.” (I. B. B.)]

This species is very close to *O. auriculare*, Gray, of which the habitat is unknown, but the columellar margin is more expanded and the ribbing is coarser and more distant than in *O. balfouri*.

Cyclostoma albicans, Sow, apud Gray, Zool. Beechey's Voy. pl. xxxviii. fig. 30, p. 146, is said to inhabit some of the islands of the Southern Pacific, which I do not believe is correct. The description agrees with this shell; but no dimensions are given, and the

inferior figure represents a shell with a high spire, not nearly globular : it is certainly not to be identified with Sowerby's figure in the *Thes. Conch.* pl. xxvi.

OTOPOMA COMPLANATUM, n. sp. (Plate XXVII. figs. 3, 3 a.)

Shell turbate, openly umbilicated, fine spiral ribbing crossed by transverse finer ribbing, smooth on base; colour white; spire pyramidal, $1\frac{1}{2}$ whorl at the apex smooth; suture impressed; whorls 5, sides well rounded; aperture ovate, suboblique, angular above; peristome continuous, thickened and scarcely reflected on the outer margin, which is well rounded; columellar margin oblique to axis, thin, with a well-marked submedian angulation near the umbilicus, but with no tendency to an expansion in that direction.

Size :—

Major diam. 36·8, minor diam. 29·5, alt. axis 16·8 millims.

[“Very common on the limestone plains from more than one locality, and common on the land towards the east end of the island; all the land in this region is elevated over 700 feet and is of limestone.” (I. B. B.)]

Somewhat like *Cyclostoma albicans*, Sow. *Thes. Conch.* p. 118, pl. xxvi. figs. 110–112, in form of the aperture and its smooth surface.

OTOPOMA CLATHRATULUM, var. *SOCOTRANA*. (Plate XXVII. figs. 4, 4 a.)

Shell very globosely turbate, closely umbilicated, spiral ribbing on the apical whorls crossed by transverse striation, becoming smoother on the body-whorl, which only shows the latter; colour white, also pale purple, stronger on the apex; bordering the suture in one specimen numerous pale purple bands of colour occur, showing darkish above the periphery (fig. 4 a); spire pyramidal, suture impressed; whorls 4, well rounded; aperture subvertical, oval, angulate above; peristome continuous, almost separated from the penultimate whorl, not reflected, thickened on the outer margin; columellar margin suboblique, nearly straight, with only a very slight tendency to angulation. Operculum shelly, situated close to the peristome, paucispiral, of three whorls rapidly increasing, nucleus subcentral, flat in front.

Size :—

Major diam. 28·5, minor diam. 22·6, alt. axis 13·5 millims.

„ „ 1·22, „ „ 0·88, „ 0·55 inch.

[“Very common everywhere.” (I. B. B.)]

This species is very closely allied to *O. clathratulum*, Récluz, figured in *Conch. Icon.* pl. xviii. fig. 116 b; but in none of the Socotran shells do we find the columellar margin expanded, as seen in Mr. Sowerby's drawing; and I have examined the specimens in the British Museum : fig. 116 a is that of a well banded specimen, but is much overcoloured. Both Arabia and Socotra are given as the habitat of this species; but there is some doubt as to which locality the above specimens are to be assigned to, as they are stuck upon the same tablet.

OTOPOMA CLATHRATULUM, var. *MINOR*.

Shell closely umbilicated, very globosely turbinate, solid, polished, sculpture regular spiral ribbing, crossed by fine transverse irregular costulation; colour white, one specimen dark grey on the apex; spire conoid, apex blunt, and smooth for $1\frac{1}{2}$ whorl; whorls $4\frac{1}{4}$; aperture ovate; peristome simple, strong, and attached close to the penultimate whorl. Operculum situated close to the peristome, very thick and shelly, the subcentral nucleus slightly sunken below the outer whorl; dark grey in central portion.

Size:—

Major diam. 0.54, minor diam. 0.40, alt. axis 0.40 inch.

„ „ 18.0 „ „ 15.3, „ „ 16.6 millims.

[“On plain near Gollonsir village, very common.” (I. B. B.) The greater number, however, are marked “very common, from the plain in vicinity of Kadhab.”]

This shell is very similar to the last, but only about half the size; and the difference in the position of the peristome with respect to the penultimate whorl is very marked and constant.

OTOPOMA CONICUM, n. sp. (Plate XXVIII. fig. 1.)

Shell conoid, closely umbilicated, solid; sculpture fine, regularly disposed spiral ribbing crossed by fine costulation, continued to well within the umbilical region; colour white; spire conic, sides rather flat, apex subacute; suture rather shallow; whorls 5, the last well rounded, slightly descending, aperture circular, suboblique; peristome very thin; columellar margin simple, not reflected. Operculum shelly, solid, paucispiral, of 3 whorls, smooth subcentral nucleus depressed, concave behind.

Size:—

Major diam. 0.24, minor diam. 0.20, alt. axis 0.32 inch.

„ „ 11.0, „ „ 10.0, „ „ 7.0 millims.

[“From the plain about Gollonsir village.” (I. B. B.)]

OTOPOMA TURBINATUM, n. sp. (Plate XXVIII. fig. 2.)

Shell turbinate, umbilicated; sculpture regular, fine, equally distributed, spiral ribbing smooth on the last whorl near umbilicus; apex smooth; colour white; spire pyramidal, suture impressed; whorls $4\frac{1}{2}$, well rounded; aperture nearly circular, slightly angular above; peristome thin, much curved on the columellar margin. Operculum not obtained.

Size:—

Major diam. 8.8, minor diam., 7.9, alt. axis 5.0 millims.

„ „ 0.35, „ „ 0.33, „ „ 0.23 inch.

[“On stems of *Dracæna cinnabari*, Balf. fil., at 2000 feet elevation, on limestone.” (I. B. B.).] Only three specimens were obtained.

TROPIDOPHORA SOCOTRANA, n. sp. (Plate XXVIII. fig. 3.)

Shell trochiform, umbilicated, rather solid; sculpture three strong

longitudinal ribs on the periphery, with a fine intermediate one, and two above near the suture, crossed by strong lateral close ribbing or lines of growth; similiar longitudinal sulcation on the base, smooth on the apex; colour white, ruddy within the aperture; spire pyramidal, sides flat; suture shallow; whorls $5\frac{1}{2}$, convex, the last slightly descending near the aperture; this is circular and oblique; peristome rather thin.

Operculum subtestaceous, paucispiral, rapidly increasing, nucleus subcentral (fig. 3*b*).

Size:—

Major diam. 10·0, minor diam. 9·2, alt. axis 6·4, total alt. 9·0 millims.

„ „ 0·39, „ „ 0·36, „ „ 0·25, „ „ 0·24, inch.

[“From stems of *Dracæna cinnabari*, Balf. fil. on limestone, at an altitude of over 2000 ft.” (B. B.)] Fifteen specimens were found.

Two specimens are somewhat larger, and, being older, have flatter sides to the spire, and a blunter apex. They measure respectively:—

1. Major diam. 12·0, minor diam. 10·8.

„ „ 0·47, „ „ 0·43.

2. „ „ 11·0, „ „ 9·5, alt. axis 6·0 millims.

TROPIDOPHORA BALFOURI, n. sp. (Plate XXVIII. fig. 4.)

Shell elongately pyramidal, umbilicated, keeled, solid; first two apical whorls smooth, rest of shell ribbed spirally and on the base; seven ribs on each whorl, crossed by well-developed transverse ribbing; colour marbly white, ruddy brown or orange within; spire pyramidal acuminate, sides flat; suture shallow; whorls 6, sides convex, the last descending very slightly near the peristome; aperture broadly ovate; peristome rather thin, continuous.

Size:—

Major diam. 7·5, minor diam. 7·0, alt. axis 6·3, total height 8·7 millims.

[“On the limestone ridge to the S.W. of Gollonsir valley, only on the top of the ridge and facing the south.” (I. B. B.)]

LITHIDION MARMOROSUM, n. sp. (Plate XXVIII. fig. 6.)

Shell discoid, very solid, widely and openly umbilicated, sharply keeled; sculpture, strongly ribbed longitudinally with 5 sulcations below and 4 above the peripheral sulcation, crossed by very fine lateral regular striation; colour marbly white; spire flatly depressed, apex papillate, polished; suture shallow; whorls 5, eccentrically wound at the apex, the axis there not being perpendicular to the planes of the last whorl (figs. 6*b* and 6*c*); aperture circular, oblique; peristome reflected, strongly developed on the columellar margin.

Operculum shelly, concentric, of 3 whorls; the margin reflected, forming a raised spiral rib.

Size. Major diam. 10·7, minor diam. 9·2, alt. axis. 3·2 millims.

Animal pale ash-grey; tentacles black; foot divided longitudinally; proboscis long, bilobed.

1



1a



2



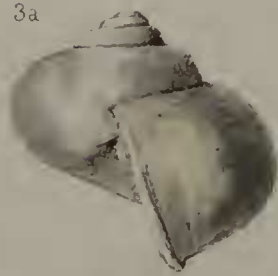
2a



3.



3a



1b.



4.



4a



SOCOTRAN LAND SHELLS

